can be achieved with conservative management consisting of rest, careful monitoring, periodic reassessment, and antiplatelet drugs.

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Simplified technique for surgical ligation of the left atrial appendage in high-risk patients

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The left atrial appendage (LAA) is the most frequent site of clot formation in patients with atrial fibrillation. The stroke rate in patient with atrial fibrillation is 12% per year at any age in clinical trial populations with a history of thromboembolism.[1-3]

Ligation of the LAA is commonly performed during cardiac surgery procedures.[1] Complete obliteration of the communication between the LAA and the body of the left atrium (LA) is mandatory to eliminate the potential for stagnant blood flow[2] but challenges the cardiac surgeon. Many studies reported incomplete closure of the LAA after surgical procedures, which may even increase the risk of embolization.[4,5]

This work describes our initial experience with a new simple surgical ligation of the LAA during cardiac surgery procedures. This technique enables "complete" obliteration of the LAA in high-risk patients undergoing cardiac surgery.

Surgical Technique

Operations were performed by five cardiothoracic surgeons in one institution. Ligation of the LAA was accomplished during open chest cardiac surgery through complete or partial upper sternotomy. During cardiac arrest the heart was positioned as for lateral wall revascularization. As a first step, the epicardial base of the LAA was carefully mobilized, avoiding tissue bunching to increase the distance between the LAA and the circumflex artery. A Derra clamp was placed at the base of the LAA with attention to the circumflex artery. Two 90-cm 2–0 nonabsorbable Mersilene ligatures (Ethicon, Inc, Somerville, NJ) were knotted sequentially at the base of the LAA approximately 5 mm from each other. The clamp was moved stepwise during this procedure. The ligatures were controlled for bleeding or dehiscence (Figure 1).

Echocardiographic Assessment

Echocardiography was performed according to American Society of Echocardiography guidelines with a Wingmed Vivid 5 cardiac ultrasound scanner (GE Medicals, Fairfield, Conn). Multiplanar transesophageal echocardiography was performed in all patients intraoperatively, exploring the LAA in various planes from 0° to 120°. Maximal LAA areas were measured by tracing a line from the top of the upper pulmonary vein limbus along the entire endocardial LAA border. The LA and LAA were closely inspected for the presence of thrombi and spontaneous echo contrast. Surgical ligation of the LAA was clearly identified by the lack of any anatomic structure between the mitral valve base and the upper left pulmonary artery. Incomplete ligation was diagnosed by color Doppler flow, demonstrating a jet traversing the separation between the LAA and the LA body.

Results

From January 2006 until February 2007, 259 consecutive patients with atrial fibrillation and contraindication to long-term warfarin therapy or high risk for thromboembolism based on the presence of congestive heart failure, diabetes mellitus, hypertension, history of stroke, or transient ischemic attack undergoing cardiac surgery

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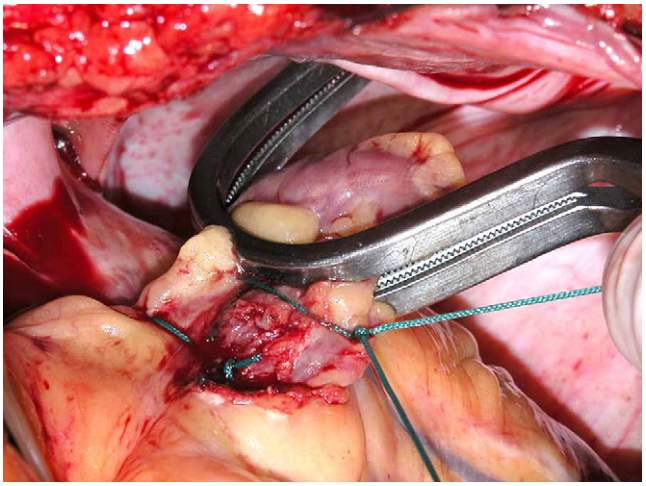

Figure 1. A Derra clamp was placed at the base of the LAA with attention to the circumflex artery to avoid puckering of the vessel. The clamp was removed. The ligatures were controlled for bleeding or dehiscence.

were included in this study. Table 1 demonstrates patient characteristics and operative data. There was no echocardiographic evidence of incomplete closure or spontaneous echoes in the LAA in any patient. Rethoracotomy for bleeding of the LAA had to be performed in 2 patients (0.7%). New postoperative neurologic complications such as permanent neurologic deficits occurred in 4 patients (1.5%) and temporary neurologic deficits in 3 patients (1.2%).

Conclusions

Initial experience with the new technique demonstrated a rapid, safe, and simple application with complete exclusion of the LAA. Postoperative stroke rate was low in this high-risk patient group. The only significant complication was bleeding of the proximal ligature, which could be avoided by more mobilization of the LAA base in the latter patients to avoid tissue tears. In our patient cohort, there was no echocardiographic evidence of persisting leaks, which was described for simple ligature techniques or sewing in techniques during maze procedures. Compared with stapling techniques, our method is cheaper and avoids LAA resection. Continuous follow-ups are warranted to determine the long-term competent closure of the LAA.

TABLE 1. Patient demographics and perioperative data (n = 259)

Demographics	
Male	143
Female	116
Age (mean ± SD)	62 ± 14
Atrial fibrillation	138
Hypertension	150
Diabetes mellitus	112
History of stroke or neurologic TIA	66
NYHA class III	140
Operative data	
MVR	41
CABG	126
AVR	68
MVR+TVR	18
TVR	6
Operative time (min)	230 ± 54
CPB time (min)	154 ± 42
Myocardial ischemic time	103 ± 69

TIA, Transient ischemic attack; *NYHA,* New York Heart Association; *CABG,* coronary artery bypass grafting; *AVR,* aortic valve replacement; *MVR,* mitral valve reconstruction; *TVR,* tricuspid valve replacement; *CPB,* cardiopulmonary bypass.

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